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Non-disclosure application

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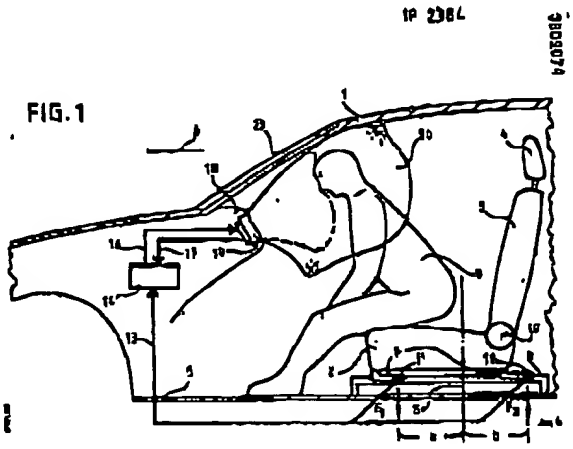
(54) Safety system for vehicles which incorporates an inflatable airbag

An airbag (20) unfolds to optimum effect if the vehicle occupant (9) occupies a normal position in the vehicle seat (2) immediately before a frontal collision. If a case occurs where the vehicle occupant (9) has just leaned forward towards the instrument panel (18) in the given situation, then because of the short clearance to the airbag (20), which was initially folded, serious injuries can occur during its explosive unfolding.
To prevent this, in the case of an airbag (20) which can be either completely inflated or only partially inflated by means of a control circuit (14), additional means (11, 12) are provided which detect the seat position (centre of gravity position) of the vehicle occupant (9) and act on the control circuit (14) in a manner whereby if a vehicle occupant (9) has moved relatively far forward in the direction of travel (6), the airbag (20) is only partially unfolded, whilst if the centre of gravity is in a position characterising the normal seated position, the airbag completely unfolds.

Fig. 1



Description

The invention relates to a safety system for vehicles which incorporates an inflatable airbag with the further features of the characterising clause of Claim 1.

A safety system of the type is known from DE-OS 27 45 620. In this case, the airbag for the front passenger can be inflated in two stages, with the first stage being triggered when the increase in deceleration reaches a first lower threshold value and the second stage being triggered when a second higher threshold value is reached. The driver's airbag is also designed to be inflated at the same time. Furthermore, a delay element is provided which delays the triggering of the second inflation stage by a defined time span compared to the triggering of the first inflation stage.

The purpose of the triggering in stages is in principle to enable the safety system to be better adapted to the seriousness of the accident and furthermore reduce the maximum sound pressure to which the occupants of the vehicle are exposed due to the almost explosive unfolding of the airbag.

In principle, an airbag unfolds to optimum effect if the vehicle occupant occupies a "normal" position in the vehicle seat immediately before a frontal collision. However, this cannot always be assumed and thus the situation on the front passenger side is frequently found where the vehicle occupant for a variety of reasons has just leaned forward towards the instrument panel. Furthermore, where the front passenger seat is occupied by a child, a similar attitude is frequently to be observed because they become relatively restless during long journeys. Precisely in such situations the clearance between the

body of the vehicle occupant, particularly the head, and the instrument panel containing the airbag, which is initially folded, is relatively small.

If in such a situation the vehicle undergoes an impact which triggers the safety system, it is possible that the airbag impact on the vehicle occupant can cause very serious injuries to the occupant. This impact cannot be reduced by dividing the unfolding operation into two stages because these stages follow each other in extremely short time periods.

It is therefore the object of this invention to further develop the safety system of this type in such a manner that accident situations such as those outlined above are taken into consideration, so that in every case serious injury to the vehicle occupant due to the airbag can be prevented.

This object is achieved according to the invention by a safety system which has the further features according to the characterising feature of Claim 1.

In this case, the airbag inflates in relation to the particular given situation (front passenger seat is occupied). If the front passenger seat is unoccupied, no activation of the airbag takes place, and the airbag is thus available for further use. Furthermore, no damage occurs to the housing and the adjacent parts such as the instrument panel due to the explosive inflation which would otherwise happen. The application is also to be recommended for protecting vehicle occupants in the rear seats.

Further advantages and features are shown in the sub claims as well as the following description of an example of the embodiment. The associated drawings are as follows:

Fig. 1 A schematic representation showing the arrangement or assignment of the elements of the safety system according to the invention.

body of the vehicle occupant, particularly the head, and the instrument panel containing the airbag, which is initially folded, is relatively small.

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Further advantages and features are shown in the sub claims as well as the following description of an example of the embodiment. The associated drawings are as follows:

Fig. 1 A schematic representation showing the arrangement or assignment of the elements of the safety system according to the invention.

Fig. 2 A block diagram showing the functioning of the control circuit.

Fig. 1 shows an outline of a vehicle 1 with a vehicle seat 2 complete with associated backrest 3 and fitted headrest 4. The attachment of the vehicle seat 2 to the vehicle floor 5 is by means of guide rails comprising slide rails 7 arranged to the left and right, viewed in the direction of travel 6, which are guided lengthwise in the guide rails 8. The vehicle occupant 9 can thus adjust the vehicle seat 2 to suit his personal wishes and also adjust the slope of the backrest 3 by means of an additional adjusting mechanism 10.

A sensor 11, 12 is fitted to each slide rail 7 at the front and rear to measure pressure forces (F_1, F_2). This produces the sum ($F_1 + F_2$) of the forces due to weight, comprising the weight of the vehicle seat 2, backrest 3, headrest 4 and vehicle occupant 9. The arrangement of the sensors 11, 12 is chosen so that their distance on both sides from a centre of gravity line (S) of the seat system (including the vehicle occupant 9 and with a mid setting of the inclination of the backrest 3) is approximately equal ($a = b$). The action lines of forces F_1 and F_2 also accordingly run parallel to the centre of gravity line (S).

The measured values determined by the sensors 11,12 are applied via a line 13 to a control circuit 14, which operates in the manner shown in Fig. 2. The control circuit 14 is in turn connected by suitable line connections 16,17 to a multiple generator system 19 integrated into an instrument panel 19 or steering wheel of the vehicle 1, which contains an airbag 20. The generator system 19 contains state-of-the-art functional elements to unfold the airbag 20 in stages in the event of vehicle deceleration determined by sensors. Fig. 1 shows the airbag in a spatial expansion, which occurs if all inflation stages become effective. From this it can be seen that with an explosive inflation a vehicle occupant 9 leaning relatively far forward would be struck by the full impact of

the airbag 20 and could thus suffer serious injuries. On the contrary, the behaviour would be different in the case of a partially-inflated airbag 20, such as is indicated by the broken line in Fig. 1. In this case, the actual purpose of the airbag 20 would be taken into consideration, namely the protection of the head area of the vehicle occupant against striking the instrument panel 18 or windscreen 23.

Fig. 2 shows the functioning of the control circuit 14. The pressure forces F_1 and F_2 determined by the sensors 11,12 are continuously read by the electronic control system in the control circuit. Furthermore, a constant (X) allows for the small additional weight (e.g. item of luggage) placed on the vehicle seat (2). The constant (X) is in any case to be set so low (e.g. 5 - 10 kg) that a vehicle occupant 9 seated on the vehicle seat 2 would not come within this tolerance range.

If a frontal impact now occurs, this is detected by a deceleration sensor, for instance within the generator system 19 and corresponding signals are sent via the control line 15 to the control circuit 14. This signal is represented in Fig. 2 by junction 24. If a frontal impact now occurs and at the same time the sum of F_1 and F_2 is within the tolerance range of X (junction 25), no firing of the generator system 19 takes place and the airbag 20 thus remains folded within its housing.

If, however, a vehicle occupant 9 is seated on the vehicle seat 2 ($F_1 + F_2 \geq X$) and is leaning relatively far forward ($F_1 > F_2$), as shown by junction 26, then a part firing (operation 27) of the generator system 19 takes place in the event of an accident (junction 24), with the result that the airbag 20 is only partially inflated. This is possible, for example, if with a multi-stage generator system 19 only a single stage is fired.

If the latter condition (junction 26) is not met, which is the case if the vehicle occupant 9 is in the normal seated position on the vehicle seat 2 and is perhaps leaning against the backrest 3 (F_2 is then always greater than F_1), then in the case of an accident (junction 24) a firing of all the stages takes place in the generator system 19 through the power connection 16, triggering the airbag 20 to fully unfold (operation 28).

Claims

1. Safety system for vehicles which incorporates an inflatable airbag to protect a vehicle occupant in the event of the vehicle colliding with an obstacle, whereby the airbag is partially or fully inflated depending on whether a lower threshold value of the vehicle increased deceleration is reached, characterised in that the means (11,12) is provided which detects the seated position (centre of gravity position) of the vehicle occupant (9) on the vehicle seat (2) and acts on the control circuit (14) which triggers the inflation of the airbag (20), in such a way that if the vehicle occupant (9) is leaning relatively far forward in the direction of travel (6) only a partial inflation of the airbag (20) occurs, whereas full inflation is triggered if there is a centre gravity position characterising the normal seated position.

2. Safety system in accordance with Claim 1, characterised in that the airbag (20) is advantageously inflated in two stages, whereby a partial inflation corresponds to an activation of only the first stage.

3. Safety system in accordance with Claim 1, characterised in that the means for detecting the seated position of the vehicle occupant (9) is provided by sensors (11,12) in a seat mounting (7,8) which measures the compressive forces, i.e. forces due to weight (F_1, F_2).

4. Safety system in accordance with Claim 3, characterised in that the sensors (11,12) are mounted on slide rails (7) in the front and rear area of the vehicle seat (2) in such a manner that their distance on both sides from a centre of gravity line (S) of the seat system is approximately equal ($a = b$) assuming

the normal seated position of the vehicle occupant (9) with the backrest (3) inclined at its mid position.

5. Safety system in accordance with Claim 1, characterised in that a constant (X) is provided within the control circuit (14), which takes account of any additional weight placed on the vehicle seat (2), as a force due to weight tolerance range.

6. Safety system in accordance with Claim 5, characterised in that in the event of a vehicle deceleration characterising an accident where the correlation ($F_1 + F_2 < X$) is present, no inflation of the airbag (20) takes place, and that where the correlation ($F_1 + F_2 \geq X$) and ($F_1 > F_2$) is present only a partial inflation of the airbag (20) takes place and finally where the correlation ($F_1 + F_2 \geq X$) and ($F_1 < F_2$) is present a complete inflation of the airbag (20) results.

7. Safety system in accordance with any of Claims 1 - 6, characterised in that the sensors (11,12) are connected by means of line (13) to the control circuit (14), which in turn is connected by means of suitable line connections (16,17) to a multiple generator system (19) integrated into an instrument panel (18) or in the vicinity of the steering wheel of a vehicle (1).

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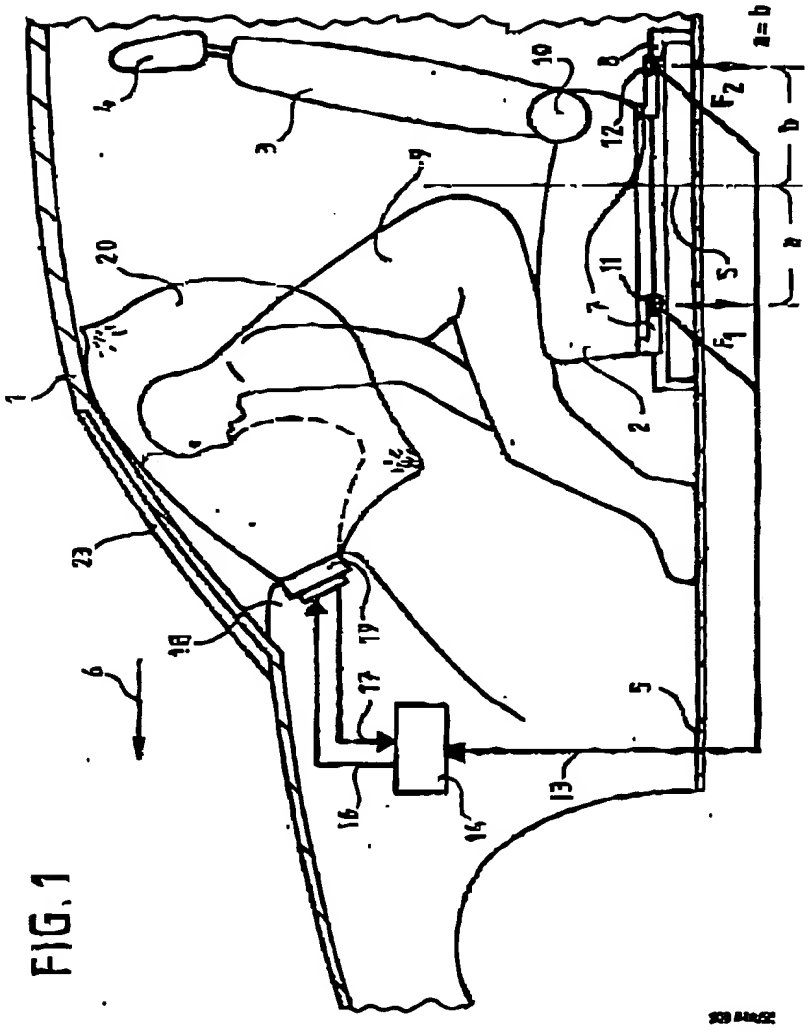

FIG. 1

FIG. 2

9*

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